(45) Date of publication and mention of the grant of the patent: 19.05.2010 Bulletin 2010/20

(21) Application number: 04008429.5

(22) Date of filing: 07.04.2004

(54) **Method for cell reselection in an MBMS mobile communication system**

Verfahren zur Zellenwiederwahl in einem MBMS Mobilkommunikationssystem

Procédé de resélection de cellule dans un système MBMS de télécumunication mobile

(51) Int Cl.: H04W 36/08 (2009.01)

(84) Designated Contracting States: DE FR GB IT


(43) Date of publication of application: 13.10.2004 Bulletin 2004/42

(60) Divisional application: 07019284.4 / 1 874 075

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(56) References cited:

- "Definitions and Characteristics of Multicast Channels" TSG RAN WORKING GROUP 2 (RADIO LAYER 2 AND RADIO LAYER 3), 8 March 1999 (1999-03-08), pages 1-11, XP002275698
- "Universal Mobile Telecommunications System (UMTS); Multimedia Broadcast/Multicast Service (MBMS); Stage 1 (3GPP TS 22.146 version 5.2.0 Release 5); ETSI TS 122 124 146" ETSI STANDARDS, EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE, SOPHIA-ANTIP, FR, vol. 3-SA1, no. V520, March 2002 (2002-03), XP014007342 ISSN: 0000-0001

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Description

[0001] The present invention relates generally to mobility support in a mobile communication system, and in particular, to a method of cell selection in a user equipment (UE) supporting Multimedia Broadcast/Multicast Service (MBMS).

[0002] Currently, as a result of the development of communication technology, services provided in a Code Division Multiple Access (CDMA) mobile communication system are developing into Multicasting/Multimedia Communication services for transmitting the existing voice service data and additional large amounts of data such as packet data and circuit data.

[0003] In a Universal Mobile Telecommunication Service (UMTS) system, which is a 3rd generation (3G) mobile communication system employing Wideband Code Division Multiple Access (WCDMA) based on Global System for Mobile communications (GSM) and General Packet Radio Services (GPRS), Broadcast/Multicast Service in which the same data stream is provided from one data source to a plurality of user equipments (UEs) is supported in order to support the Multicasting/Multimedia Communication. The Broadcast/Multicast Service can be classified into Cell Broadcast Service (CBS), which is a message-oriented service, and Multimdedia Broadcast/Multicast Service (MBMS service) for supporting multimedia data including real-time images and voice, still images, and text.

[0004] FIG. 1 is a diagram schematically illustrating a network configuration for providing an MBMS service in a mobile communication system. Referring to FIG. 1, a multicast/broadcast-service center (MB-SC) 110 provides an MBMS stream, and the MS-SC 110 schedules an MBMS service stream and sends the scheduled MBMS service stream to a transit network (NW) 120. The transit network 120 is a network existing between the MB-SC 110 and a serving GPRS support node (SGSN) 130, which sends the MBMS service stream provided from the MB-SC 110 to the SGSN 130. The transit network 120 is comprised of a gateway GPRS support node (GGSN) and an external network.

[0005] The SGSN 130 receiving an MBMS service stream via the transit network 120 controls an MBMS service for the subscribers, i.e., UEs 161, 162, 163, 171, and 172, requesting the MBMS service. For example, the SGSN 130 manages MBMS service accounting data for each of the subscribers, and selectively transmits MBMS service data to an associated radio network controller (RNC) 140. In addition, the SGSN 130 generates and manages a service context for the MBMS service and sends a stream for the MBMS service to the RNC 140.

[0006] The RNC 140 transmits the MBMS service stream to Node Bs 160 and 170 controlling the cells where the UEs 161, 162, 163, 171, and 172 requesting an MBMS service are located, among the Node Bs managed by the RNC 140 itself. The RNC 140 and the Node Bs 160 and 170 constitute a UMTS terrestrial radio access network (UTRAN).

[0007] A cell 1, which belongs to the Node B 160 that is requesting a particular MBMS service, includes the UE1 161, the UE2 162, and the UE3 163, and a cell 2, which belongs to the Node B 170, includes the UE4 171 and the UE5 172. Herein, the term "cell" has a meaning similar to that of the term”Node B." The RNC 140 controls radio channels set up between the Node Bs 160 and 170 and the UEs 161, 162, 163, 171, and 172 in order to provide the MBMS service. As illustrated in FIG. 1, one radio channel is established between one Node B and UEs belonging to the Node B in order to provide an MBMS service.

[0008] In such an MBMS service system, when a UE receiving an MBMS service moves from one cell, i.e., a serving cell, to another cell, i.e., a target cell, the control of the UE must be handed over from the serving cell to the target cell by a cell reselection procedure. More specifically, the UE must acquire information on the target cell in order to continuously use the same MBMS service as that used in the serving cell. The target cell information includes control information for accessing a transport channel for carrying a data stream for an MBMS service in the target cell. As a result, during cell reselection, delay occurs when acquiring information on the target cell by the UE. Further, this delay prevents the user from seamlessly receiving the MBMS service while moving between cells. Accordingly, there is a demand for cell reselection technology that enables a UE to rapidly acquire information on a target cell while moving between cells, thereby seamlessly providing an MBMS service.

[0009] The TSG RAN Working Group 2 (Radio Layer 2 and Radio Layer 3) has issued a paper headlined "Definitions and Characteristics of Multicast Channels" (8 March 1999, pages 1-11, XP002275698) in which an overview about definitions and characteristics of multicast channels is given. The operation of multicast service is described and transport and physical channels for multicast service are disclosed.

[0010] WO03017713 discloses a method and system for a handoff in a broadcast communication system. To streamline the autonomous handoff decision process, several distinct sets of pilot identifiers and rules for transitioning among the sets are defined. To fully integrate broadcast services with the services provided by the cellular telephone systems in a subscriber environment, methods for various handoff scenarios are analysed.

[0011] It is the object of the present invention to provide a method for seamlessly receiving an MBMS service while an UE moves between cells.

[0012] The object is solved by the subject matter of the independent claims.

[0013] Preferred embodiments of the present invention are defined by the dependent claims.

[0014] It is a further aspect of the present invention to provide a method for providing an efficient service by supporting mobility of a UE receiving an MBMS service.
[0015] It is still a further aspect of the present invention to provide a method for efficiently maintaining call mobility of a UE by previously storing MBMS control information needed by the UE to receive MBMS data from neighbor cells.

[0016] According to a first aspect of the present invention, in a mobile communication system including a plurality of cells and providing a Multimedia Broadcast/Multicast Service (MBMS) service, there is provided a cell reselection method by a user equipment (UE) receiving the MBMS service in a serving cell, which is one of the plurality of cells. The method comprises the steps of: receiving control data of the serving cell, including configuration information necessary for accessing MBMS control channels (MCCHs) of neighbor cells and control information necessary for accessing an MBMS data transport channel (MTCH) of the serving cell, over an MCCH of the serving cell, and storing the received control data, while the MBMS service is provided in the serving cell; and if cell reselection to a target cell, which is one of the neighbor cells is determined, moving to the target cell by consulting configuration information stored for the target cell.

[0017] According to a second aspect of the present invention, in a mobile communication system including a plurality of cells and providing a Multimedia Broadcast/Multicast Service (MBMS) service, there is provided a method for providing an MBMS service to a user equipment (UE) moving between the cells. The method comprises the steps of: transmitting system information including information on a secondary common control physical channel (S-CCPCH) according to the second embodiment of the present invention; transmitting system information related to a code channel to which an MBMS control channel (MCCH) of the cell and second system information related to a code channel to which an MCCH of the cell is mapped; and transmitting control information necessary for accessing an MBMS data transport channel (MTCH) of the cell over an MCCH of the cell.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The above and other objects, features, and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a diagram schematically illustrating a configuration of a conventional mobile communication system supporting an MBMS service;
FIG. 2 is a diagram illustrating a cell reselection problem occurring in a UE receiving an MBMS service;
FIG. 3 is a diagram illustrating a format of a primary common control physical channel (P-CCPCH) according to the present invention;
FIG. 4 is a diagram illustrating a format of a secondary common control physical channel (S-CCPCH) according to the present invention;
FIG. 5 is a flowchart illustrating a cell reselection operation of a UE in a conventional mobile communication system; FIG. 6 is a flowchart illustrating a cell reselection operation of a UE in a mobile communication system supporting an MBMS service according to the present invention;
FIG. 7 is a diagram illustrating a format of system information blocks (SIBs) according to a first embodiment of the present invention;
FIGs. 8A and 8B are flowcharts illustrating a cell reselection operation of a UE according to the first embodiment of the present invention;
FIG. 9 is a diagram illustrating a format of SIBs according to a second embodiment of the present invention;
FIG. 10 is a diagram illustrating a format of a primary common control physical channel (P-CCPCH) and a secondary common control physical channel (S-CCPCH) according to the second embodiment of the present invention;
FiGs. 11A and 11B are flowcharts illustrating a cell reselection operation of a UE according to the second embodiment of the present invention; FIG. 12 is a diagram illustrating a format of SIBs according to a third embodiment of the present invention; and
FiGs. 13A to 13C are flowcharts illustrating a cell reselection operation of a UE according to the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0021] Several preferred embodiments of the present invention will now be described in detail herein below with reference to the annexed drawings. In the following description, a detailed description of known functions and configurations incorporated herein has been omitted for conciseness.

[0022] In the present invention, a UE receiving an MBMS service previously stores MBMS service-related information of neighbor cells to which it can move, thereby preventing call delay at cell reselection. In the specification, the term "MBMS service-related information" refers to information necessary for receiving the MBMS service in neighbor cells, and includes information related to a traffic channel and a control channel for the MBMS service.

[0023] However, before a description of preferred embodiments of the present invention is given, an MBMS service of a UE will be described herein below. More specifically, a physical channel and a transport channel for the MBMS service in neighbor cells from a serving cell currently maintained by an RNC to stay in a particular state, e.g., Cell_FACH state, or a URA_PCH state.

[0024] FIG. 2 is a diagram schematically illustrating a procedure for performing cell reselection by a UE using an MBMS service while moving from one cell to another cell. As illustrated in FIG. 2, a cell 1 160 supports an MBMS service through a primary common control physical channel (P-CCPCH) 165, a secondary common control physical channel (S-CCPCH) 166, and an MBMS data transport channel (MTCH) 164. Similarly, a cell 2 170 supports an MBMS service through a P-CCPCH 175, an S-CCPCH 176, and an MTCH 173. The MTCHs 164 and 173 carry MBMS service traffic, or data streams. It is assumed herein that the cell 1 160 and the cell 2 170 are controlled by one RNC 140. A UE 1 161 receiving the MBMS service from the cell 1 160 moves to the cell 2 170 under the control of the RNC 140 if a signal transmitted from the cell 2 170 satisfies a predetermined condition. Such inter-cell movement is called "cell reselection."

[0025] FIG. 3 is a diagram illustrating a format of the P-CCPCHs 165 and 175. Referring to FIG. 3, the P-CCPCH transmits system information of a corresponding cell, and uses a first code C(256,1) among 256 orthogonal variable spreading factor (OVSF) codes available for the corresponding cell. More specifically, the P-CCPCH transmits one master information block (MIB) and one system information block (SIB) for each 80-ms period.

[0026] The MIB includes information used to determine whether scheduling information (i.e., scheduling information for each SIB) and system information have been changed, and is repeatedly transmitted for each 80-ms period. The SIB is classified into a total of 16 types of SIBs according to the types of information contained therein, and several typical SIBs will be described herein below.

[0027] SIB 1 contains various timer and counter values and information related to a core network (CN). SIB 2 contains an identifier (ID) of a UTRAN registration area (URA) to which a corresponding cell belongs. SIB 3 contains information necessary for cell selection and reselection. SIB 4 contains information necessary for cell selection and reselection, to be used by a UE in a connected mode. SIB 5 contains information related to common channels established in a corresponding cell. SIB 6 contains information related to common channels of a corresponding cell, to be used by a UE in a connected mode.

[0028] A UE not having a dedicated channel (DCH) receives SIBs transmitted over the P-CCPCH and stores necessary information in order to receive a service from a particular cell. In particular, the UE receives S-CCPCH-related information of a corresponding cell through the SIB 5 or SIB 6, and accesses an S-CCPCH using the information.

[0029] FIG. 4 is a diagram illustrating a format of the S-CCPCHs 166 and 176. Referring to FIG. 4, the S-CCPCH is mapped with common transport channels such as a forward access channel (FACH) and a paging channel (PCH) for an upper layer. Each radio frame of the S-CCPCH is comprised of 15 slots, and each slot includes a data part 420, a transport format combination indicator (TFCI) part 410, and a pilot part 430. The data part 420 carries (contains) data on a FACH or a PCH. The TFCI part 410 receives TFCI information indicating a transport format (TF) of data transmitted over the data part 420. The pilot part 430 receives pilot bits, which are identification information of a corresponding cell.

[0030] The FACH is not a channel subjected to one UE but a transport channel shared by a plurality of UEs. Nevertheless, the FACH is used to transmit data and control information for a particular UE. A UE instructed by an RNC to stay in a particular state, e.g., Cell_FACH state, receives all FACH data transmitted over the S-CCPCH, processes desired data by checking a header part of the received data, and discards the remaining, undesired data.

[0031] FIG. 5 is a flowchart illustrating a procedure performed while a UE not having a dedicated channel moves from one cell to another cell in an MBMS communication system. Here, "not having a dedicated channel" means that the UE is in any one of an idle mode, a Cell_PCH state, a Cell_FACH state, or a URA_PCH state.

[0032] Referring to FIG. 5, in step 510, a UE receives information on neighbor cells from a serving cell currently...
providing an MBMS service to the UE. The information on neighbor cells includes cell IDs and scrambling codes for the neighbor cells. In order to determine whether to perform cell reselection from the serving cell to the neighbor cells, in step 520, the UE measures power levels of primary common pilot channels (P-CPICHs) sent from the neighbor cells to determine reception qualities for the neighbor cells.

[0033] In step 530, the UE compares a reception power level for the serving cell with reception power levels for the neighbor cells. If a reception power level for the serving cell is lower than reception power levels for the neighbor cells, cell reselection is not performed. However, if a reception power level for the serving cell is lower than a reception power level for any one of the neighbor cells, in step 540, the UE selects the neighbor cell having the highest reception power level as a target cell, moves to the target cell, and continuously receives the MBMS service.

[0034] In order to receive the MBMS service in the target cell, the UE should receive system information of the target cell and enter a state in which it can start communication. For that purpose, the UE acquires information needed to access channels related to the MBMS service in the target cell.

[0035] A channel carrying a data stream for an MBMS service is called an MBMS data transport channel (MTCH). When the MTCH is matched with a particular MBMS stream, if a plurality of MBMS services are provided to one cell, a plurality of MTCHs are established in the cell. In order to receive an MTCH, a UE first receives information transmitted over an MBMS control channel (MCCH). The MCCH provides control information that must be established to receive information necessary for reception of an MTCH and the MTCH. In the present invention, information carried by the MCCH will be referred to as "MTCH control information" or "MTCH data."

[0036] Only one MCCH is established in each cell. In order to receive a particular MBMS stream X, a UE acquires information related to the MTCH X over which a data stream for the MBMS service X is to be transmitted, over the MCCH, e.g., radio bearer information of an MTCH X and information on a transport channel and a data stream for the MBMS service X is to be transmitted, requires information related to the MTCH X over which a data stream is to be transmitted. In order to determine whether the UE can start receiving via an MTCH from the target cell as soon as the UE moves to the target cell.

1. Each cell periodically broadcasts control information related to an MBMS service available in the cell itself, using an MCCH.

2. A UE acquires MBMS service-related control information for a target cell before performing cell reselection so that the UE can start receiving via an MTCH from the target cell as soon as the UE moves to the target cell.

[0037] In order to implement the present invention, a UE must determine when it will acquire MBMS control information of neighbor cells. For that purpose, in preferred embodiments of the present invention, a criteria MBMS condition (criteria_MBMS) is defined. A UE acquires MBMS service-related control information only for the cells satisfying the criteria MBMS condition.

[0038] FIG. 6 is a flowchart illustrating a procedure for performing cell reselection by a UE in an MBMS communication system according to the present invention. Referring to FIG. 6, in step 610, a UE collects, from a serving cell, information on neighbor cells and information needed to determine a criteria MBMS condition. Such information is collected using either SIB 3 and SIB 4, or SIB 11 and SIB 12, or using a new SIB. A description will now be made of the collection using SIB 3 and SIB 4, or the SIB 11 and SIB 12.

[0039] The SIB 3 and SIB 4 each contain the same kind of system information for the idle mode and the Cell_PCH/URA_PCH/Cell_FACH states. Likewise, the SIB 11 and SIB 12 each contain the same system information for the idle mode and the Cell_PCH/URA_PCH/Cell_FACH states. Therefore, for the convenience of explanation, a combination of the SIB 3 and SIB 4 is expressed as SIB 3/4, and a combination of the SIB 11 and SIB 12 is expressed as SIB 11/12. The SIB 3/4 contains Q_rxlevmin, Q_qualmin, and Q_hyst as parameters needed by a UE for cell reselection. Q_rxlevmin represents a minimum value of a received signal code power (RSCP) for a P-CPICH, and Q_qualmin represents a minimum value of a signal-to-noise ratio, or a chip-energy-to-noise ratio Ec/No, for the P-CPICH. Q_hyst represents a weight provided to determine whether to use RSCP or Ec/No for cell reselection, through the SIB 3/4.

[0040] In addition, the SIB 11/12 contains cell IDs and scrambling codes as information on neighbor cells that must be measured by a UE to perform cell reselection. The UE determines a cell whose P-CPICH it will measure, by receiving the SIB 11/12.

[0041] In step 620, the UE measures signal qualities for the neighbor cells. More specifically, the UE measures Q_qualmeas, or Ec/No, and Q_rxlevmeas, or RSCP, for the P-CPICH.

[0042] In step 630, the UE determines whether the values measured from the neighbor cells satisfy a criteria MBMS condition. Herein, the cells satisfying the criteria MBMS condition are regarded as candidate cells. Whether the criteria MBMS condition is satisfied is determined by the following formulas.

Criteria MBMS Condition

\[
S_{\text{rxlev}} > 0 \quad \text{and} \quad S_{\text{qual}} > 0
\]

\[
S_{\text{rxlev}} = Q_{\text{rxlevmeas}} - Q_{\text{rxlevmin}}
\]
Calculation of $R_s$ and $R_n$

$$R_s = Q_{\text{meas}} + Q_{\text{hyst}}$$

$$R_n = Q_{\text{meas}} - Q_{\text{offset}}$$

In the foregoing formulas, $Q_{\text{meas}}$ denotes $Q_{\text{rxlevmeas}}$ or $Q_{\text{qualmeas}}$ of the serving cell. $Q_{\text{meas}}$ denotes $Q_{\text{rxlevmeas}}$ or $Q_{\text{qualmeas}}$ of the neighbor cells. $Q_{\text{hyst}}$ is a value given by the SIB 3/4 and denotes a weight for giving higher priority to the serving cell rather than the neighbor cells. $Q_{\text{offset}}$ is a value given for neighbor cells by the SIB 11/12 and serves to give priority for cell reselection to each cell. For example, an RNC designates $Q_{\text{offset}}$ of a neighbor cell 'b' having high cell reselection priority to a value lower than that of a neighbor cell 'a' having relatively higher priority.

That is, in step 650, the UE determines whether there is a candidate cell having $R_n$ that is higher than $R_s$ of the serving cell. If there is a candidate cell having $R_n$ that is higher than $R_s$ of the serving cell, the UE selects the corresponding candidate cell as a target cell.

In step 660, if MTCH control information (radio channel information of MTCH that the UE requests) for the target cell is stored in the UE, the UE moves to the target cell and turns to the MTCH of the target cell using the MTCH control information. If the UE does not have the MTCH control information for the target cell, it performs an operation necessary for acquiring MTCH control information for the target cell.

A description will now be made of some preferred embodiments of the present invention regarding a format of an MCCH for acquiring MTCH control information for the target cell by the UE.

First Embodiment

FIG. 7 is a diagram illustrating a format of SIBs according to a first embodiment of the present invention. In the first embodiment, MTCH control information is transmitted over a P-CCPCH. In the first embodiment, SIB_MTCH 730 is used, which contains information necessary for reception of MTCH and is transmitted over P-CCPCH.

Referring to FIG. 7, an RNC establishes SIB_MTCHs 730 for its own individual cells, and provides the SIB_MTCHs 730 to individual Node Bs controlling corresponding cells. If any one of the SIB_MTCHs is changed, the changed information is transmitted to a corresponding Node B.

The SIB_MTCH 730 includes MTCH control information for each MBMS service. If n MBMS services are provided in a particular cell, SIB_MTCH 730 broadcasted from the cell includes n MTCH control information blocks. The MTCH control information includes (i) an MBMS ID 731, which is an ID of an MBMS stream transmitted over a corresponding MTCH, (ii) a packet data convergence protocol (PDCP) 732 formed for an MBMS stream transmitted over a corresponding MTCH, (iii) information 733 on a radio link control (RLC) entity formed for an MBMS stream transmitted over a corresponding MTCH, (iv) a transport format set (TFS) 734 for transport formats of an MBMS stream transmitted over a corresponding MTCH, and (v) spreading factor (SF) and code number 735 for a code channel transmitting a corresponding MTCH.

A UE accesses an MTCH of a corresponding cell using the MTCH control information acquired through the SIB_MTCH 730 and receives a desired MBMS service.

Before receiving SIB_MTCH 730, the UE acquires information for cell reselection from SIB 3/4 710 and SIB 11/12 720. The SIB 3/4 710 includes $Q_{\text{qualmin}}$, $Q_{\text{rxlevmin}}$, $Q_{\text{hyst}}$, and $Q_{\text{offset}}$. As described above, the $Q_{\text{qualmin}}$ represents minimum Ec/No of P-CPICH, and the $Q_{\text{rxlevmin}}$ indicates a minimum RSCP of P-CPICH. In addition, the $Q_{\text{hyst}}$ is a value provided to give higher priority to a serving cell rather than neighbor cells.

In addition, the SIB 3/4 710 includes a criteria MBMS parameter criteria_MBMS 714 for designating a reception time of MCCH control information for neighbor cells and cell reselection criteria. For example, the criteria MBMS parameter 714 includes a bit indicating whether the UE will use RSCP or Ec/No of P-CPICH to select a target cell from the candidate cells.

The SIB 11/12 720 includes information on neighbor cells. The information on the neighbor cells includes $Q_{\text{offset}}$ for each of the neighbor cells, information 722 necessary for reception of P-CPICH, and MBMS availability information 723. The $Q_{\text{offset}}$ is a value for giving separate reselection priority to each cell. The P-CPICH information...
In step 820, the UE measures P-CPICH signals from neighbor cells. Information on the neighbor cells is received through the SIB 11/12 of the serving cell, and information on the measurement objects is received through the SIB 3/4. Parameters measured in step 820 include Q_ qualmeas, or Ec/No, and Q_rxlevmeas, or RSCP.

After measuring Q_ qualmeas and Q_rxlevmeas, the UE determines whether one of the neighbor cells satisfies a criteria MBMS condition in step 825. The "criteria MBMS condition" indicates that the RSCP measurement value Q_rxlevmeas is larger than the minimum P-CPICH RSCP value Q_rxlevmin detected through the SIB 3/4, and the Ec/No measurement value Q_qualmeas is larger than the minimum P-CPICH Ec/No value Q_qualmin detected through the SIB 3/4.

If there are neighbor cells satisfying the condition that the RSCP measurement value Q_rxlevmeas is larger than the minimum RSCP value Q_rxlevmin and the Ec/No measurement value Q_qualmeas is larger than the minimum Ec/No value Q_qualmin, the UE regards the neighbor cells satisfying the criteria MBMS condition as candidate cells, and then proceeds to step 830. However, if there are no candidate cells, the UE returns to step 820. In this case, the UE can use MBMS availability information of the neighbor cells included in the SIB 11/12 before being transmitted. That is, the UE proceeds to step 830 only when the MBMS availability of the neighbor cells is 'TRUE', and the UE returns to step 820 when the MBMS availability is 'FALSE'.

In step 830, the UE receives MIB of the candidate cells and decodes the received MIB. The MIB is broadcasted for each 80-ms period, and contains scheduling information of SIBs transmitted over the P-CCPCH. In step 835, the UE receives scheduling information of SIB_MTCH from the MIB. In step 840, the UE receives the SIB_MTCH based on the scheduling information and decodes the received SIB_MTCH.

In step 845, if MTCH control information for an MBMS service that the UE desires to receive exists in the SIB_MTCH, the UE stores the MTCH control information as MTCH_INFO, and then returns to step 820.

FIG. 8B is a flowchart illustrating a procedure for reselecting a particular target cell by a UE. The procedure of FIG. 8B is performed in parallel with or after the procedure of FIG. 8A.

Referring to FIG. 8B, in step 850, the UE starts measuring P-CPICHs from a serving cell and neighbor cells. The measurement in the step 850 is substantially identical to the measurement in the step 820. Preferably, the UE measures RSCP and Ec/No of P-CPICHs from the neighbor cells or the candidate cells determined in the step 825. In step 855, the UE determines priorities of candidate cells and a serving cell using the measurement values. The priorities are determined by comparing R_n calculated for the candidate cells with R_s calculated for the serving cell. If R_n of a certain candidate cell X is higher than R_s of the serving cell, the UE proceeds to step 860, and if R_s is higher than R_n of all candidate cells, the UE returns to step 850. Here, a candidate cell having the highest R_n among the candidate cells having R_n that is higher than R_s of the serving cell is selected as a target cell.

In step 860, the UE determines whether control information necessary for reception of MTCH from the target cell is stored in MTCH_INFO. If the control information is stored in MTCH_INFO, the UE reconstructs in step 865 a receiver using the MTCH control information and starts receiving an MBMS service data stream transmitted over MTCH of the target cell.

In the first embodiment, because the MTCH control information is transmitted over SIB_MTCH of P-CCPCH, the UE can rapidly acquire MTCH-related information of the candidate cells. However, because of the limited capacity of the P-CCPCH, when one cell provides a plurality of MBMS services, it is not easy to transmit all SIB_MTCHs for the MBMS services.

Second Embodiment

Accordingly, a second embodiment of the present invention is provided, which resolves the above-described shortcoming of the first embodiment. In the second embodiment MBMS service-related information is broadcast over an S-CCPCH in order to resolve the capacity problem of the P-CCPCH. In the second embodiment, MCCH control information for an MBMS service is periodically transmitted over an MCCH mapped to the S-CCPCH. Scheduling information of the MCCH is transmitted over an SIB_MCCH of the P-CCPCH. The S-CCPCH-related information is transmitted to UEs in a cell through SIB 5/6.

That is, a UE receives MIB of candidate cells after identifying the candidate cells according to a criteria MBMS condition, and then receives SIB_MCCH and SIB 5/6 included in P-CCPCH using the MIB. Then the UE
receives MCCH mapped to the S-CCPCH, using the SIB 5/6 and the SIB_MCCH, and acquires MTCH-related control information of the candidate cells from the received MCCH.

[0071] FIG. 9 is a diagram illustrating information necessary for supporting the second embodiment of the present invention. Referring to FIG. 9, scheduling information of MCCH is notified to UEs in a cell over SIB_MCCH 905. MCCH data 920 is transmitted over S-CCPCH. Because a format of the S-CCPCH can be formed in various ways for individual cells, a method for mapping MCCH to the S-CCPCH can also be defined in various ways.

[0072] FIG. 10 is a diagram illustrating a preferred example of transmitting MCCH data, and in this example, the MCCH data is mapped in a particular time period of S-CCPCH. Referring to FIG. 10, when a target cell is selected in order to receive an MBMS service, UEs acquires S-CCPCH-related information through SIB 5/6 910 transmitted over a P-CCPCH of the selected target cell. Further, the UE acquires scheduling information of the MCCH mapped to the S-CCPCH through SIB_MCCH 905 transmitted over P-CCPCH of the target cell. Then the UE receives MCCH control information transmitted over the MCCH 920 using the scheduling information.

[0073] The MCCH data 920 includes MTCH control information 921 and 922 for the respective MBMS services provided in a corresponding cell. The MTCH control information includes (i) an MBMS ID, which is an ID of an MBMS stream transmitted over MTCH, (ii) information on a packet data convergence protocol (PDCP) formed for an MBMS stream transmitted over a corresponding MTCH, (iii) information on a radio link control (RLC) entity formed for an MBMS stream transmitted over a corresponding MTCH, (iv) a transport format set (TFS) for transport formats of an MBMS stream transmitted over a corresponding MTCH, and (v) an SF and a code number for a code channel transmitting a corresponding MTCH.

[0074] The SIB 5/6 910 includes information 911 and 917 on common channels constituting a cell, i.e., S-CCPCH and a packet random access channel (PRACH). When transport channels such as a paging channel (PCH) and a forward access channel (FACH) are multiplexed to the S-CCPCH, TFSs 913 and 914 for the respective transport channels are notified through the SIB 5/6 910. In addition, SF and code number 915 of a code channel to be transmitted over the S-CCPCH, and transport format combination set (TFCs) information 912 of transport channels multiplexed to the S-CCPCH are also notified through the SIB 5/6 910.

[0075] The SIB_MCCH 905 includes such parameters as MCCH REP 906, MCCH POS 907, and MCCH COUNT 908, which are scheduling information of MCCH mapped to the S-CCPCH.

[0076] Referring to FIG. 10, MCCH frames 930 and 950 containing the MCCH data 920 are broadcasted on the S-CCPCH at periods of the MCCH REP 906 with a length of the MCCH_COUNT 908. A start point of the MCCH frames 930 and 950 becomes the MCCH_POS 907. A unit of the MCCH REP 906 and the MCCH_COUNT 908 becomes a radio frame having a length of, for example, 10 ms. The MCCH_POS 907 is expressed as a system frame number (SFN) of a corresponding cell. The SFN is a value broadcasted over P-CCPCH, and is a value of a radio frame unit having a value between 0 and 4095.

[0077] A UE receives the MCCH data 920 of a corresponding cell based on the MCCH_POS 907, MCCH REP 906, and MCCH COUNT 908. That is, the UE regards S-CCPCH data received for the MCCH_COUNT 908 from SFN of MCCH_POS 907 + k*MCCH REP 906 (where k = 0,···), as the MCCH data 920. The MCCH can be mapped to an FACH, which is a transport channel.

[0078] FIGs. 11A and 11B are flowcharts illustrating an operation of a UE according to the second embodiment of the present invention. First, an operation of acquiring MTCH control information of neighbor cells by a UE will be described with reference to FIG. 11A. It is assumed herein that the UE has already acquired SIB 3/4 and SIB 11/12 of a serving cell while using an MBMS service in the serving cell. The SIB 3/4 includes a criteria MBMS parameter for designating a reception time of MCCH control information for neighbor cells and cell re-selection criteria. The SIB 11/12 includes information of neighbor cells which become measurement objects, specifically, includes cell IDs and P-CPICH information. Information included in the SIB 3/4 and SIB 11/12 has already been described with reference to FIG. 7.

[0079] Referring to FIG. 11 A, in step 1020, the UE measures P-CPICHs from neighbor cells. Information on the neighbor cells is received through the SIB 11/12 of the serving cell, and information on the measurement objects is received through the SIB 3/4. Parameters measured in the step 1020 include Q_qualmeas or Ec/No, and Q rxlevmeas or RSCP.

[0080] After measuring Q_qualmeas and Q rxlevmeas for the neighbor cells, the UE determines whether one of the neighbor cells satisfies a criteria MBMS condition in step 1025. The "criteria MBMS condition" indicates that the RSCP measurement value Q rxlevmeas is larger than the minimum P-CPICH RSCP value Q rxlevmin detected through the SIB 3/4, and the Ec/No measurement value Q_qualmeas is larger than the minimum P-CPICH Ec/No value Q qualmin detected through the SIB 3/4.

[0081] If there are neighbor cells satisfying the condition that the RSCP measurement value Q rxlevmeas is larger than the minimum RSCP value Q rxlevmin and the Ec/No measurement value Q_qualmeas is larger than the minimum Ec/No value Q qualmin, the UE identifies the neighbor cells satisfying the criteria MBMS condition as candidate cells, and then proceeds to step 1030. However, if there are no candidate cells the UE returns to step 1020. In this case, the UE can use MBMS availability information of the neighbor cells included in the
SIB 11/12 before being transmitted.

[0082] In step 1030, the UE receives MIB on P-CCPCHs of the candidate cells and reads the received MIB. The MIB is broadcasted for each 80-ms period, and contains scheduling information of SIBs transmitted over the P-CCPCH. In step 1035, the UE acquires scheduling information of SIB_MCCH 905 and SIB 5/6 910 from the MIB. In step 1040, the UE reads the SIB_MCCH 905 and the SIB 5/6 910 on the P-CCPCH of the candidate cells, using the scheduling information. As described above, the SIB 5/6 910 includes code information and transport format information of the S-CCPCH, needed to receive the S-CCPCH, and the SIB_MCCH 905 includes parameters indicating a time for which the MCCH data 920 is broadcasted over the S-CCPCH.

[0083] In step 1045, the UE receives the MCCH data 920 on the S-CCPCH using the SIB 5/6 910 and the SIB_MCCH 905 and decodes the received MCCH data 920. In step 1050, if MTCH control information for an MBMS service that the UE desires to receive exists in the MCCH data 920, the UE stores the MTCH control information as MTCH_INFO, and then returns to step 1020.

[0084] FIG. 11B is a flowchart illustrating a procedure for reselecting a particular target cell by a UE. The procedure of FIG. 11B is performed in parallel with or after the procedure illustrated in FIG. 11A.

[0085] Referring to FIG. 11B, in step 1055, the UE measures P-CPICHs from a serving cell and neighbor cells. The measurement in the step 1055 is substantially identical to the measurement in the step 1020. Preferably, the UE measures RSCP and Ec/No of P-CPICHs from the neighbor cells or the candidate cells determined in step 1025.

[0086] In step 1060, the UE determines priorities of candidate cells and a serving cell using the measurement values. The priorities are determined by comparing \( R_n \) calculated for the candidate cells with \( R_s \) calculated for the serving cell. If \( R_n \) of a certain candidate cell X is higher than the \( R_s \) of the serving cell, the UE proceeds to step 1065, but if the \( R_s \) is higher than \( R_n \) of all candidate cells, the UE returns to step 1055. Here, a neighbor cell having \( R_n \) that is higher than \( R_s \) of the serving cell is selected as a target cell.

[0087] In step 1065, the UE determines whether MTCH control information of the target cell is stored in MTCH_INFO. If the MTCH control information is stored in MTCH_INFO, the UE reconstructs a receiver using the MTCH control information and starts receiving an MBMS service data stream transmitted over MTCH of the target cell in step 1070.

[0088] In the second embodiment, a specific time is required to acquire MTCH control information by the UE for neighbor cells (i.e., candidate cells) satisfying a criteria MBMS condition. That is, the UE measures signal values for neighbor cells, and if the measured values satisfy a predetermined condition, the UE receives via the P-CCPCH and S-CCPCH of the corresponding candidate cells. Accordingly, the UE must receive data via the P-CCPCH and the S-CCPCH of the candidate cells in order to acquire MTCH control information of the candidate cells.

[0089] That is, in the second embodiment, the UE must acquire MTCH control information transmitted over an MCCH after receiving MIB of candidate cells and receiving SIB 5/6 and SIB_MCCH. However, if the UE performs cell reselection to a particular target cell before it completely acquires MTCH control information of the candidate cells, the UE must receive data via MTCH of the target cell after completing acquisition of MTCH control information, inevitably causing a data loss.

Third Embodiment

[0090] A third embodiment of the present invention provides a method for transmitting MCCH configuration information of neighbor cells over an MCCH of a serving cell so that a UE can access the MCCH of the neighbor cells without receiving MIB, SIB_MCCH, and SIB 5/6 of the neighbor cells. Because the UE can directly receive MCCH data of a candidate cell using previously stored MCCH configuration information when a particular neighbor cell is recognized as the candidate cell, it is possible to reduce a time required for acquiring MTCH information.

[0091] FIG. 12 is a diagram illustrating information necessary for supporting the third embodiment of the present invention. Referring to FIG. 12, MCCH data 1110 includes MCCH configuration information MCCH_Neighbor_info 1115 of neighbor cells and MTCH control information MTCH_info 1120 of a serving cell. The MTCH control information 1120 includes information 1115 includes information for neighbor cells.

[0092] The MCCH data 1110 is transmitted over predetermined time periods of a S-CCPCH. Preferably, for example, MCCH data is mapped to specific time periods of the S-CCPCH as illustrated in FIG. 10, and information on the time period is notified to UEs over SIB_MCCH 1105.

[0093] The UE initially selects a particular serving cell in order to receive an MBMS service, acquires S-CCPCH-related information through SIB 5/6 (similar to the SIB 5/6 910 of FIG. 9) transmitted over P-CCPCH of the selected serving cell, and acquires MCCH data. Further, the UE acquires the configuration information 1115 for a desired MBMS service over MCCH of the serving cell, and also acquires MCCH data MCCH_neighbor of neighbor cells. Based on the MCCH_neighbor of neighbor cells, the UE can rapidly access MCCHs of neighbor cells when reselecting the neighbor cells.

[0094] The MCCH Neighbor info 1115 includes information on S-CCPCHs of neighbor cells, and scheduling information of MCCH data mapped to the S-CCPCHs of the neighbor cells. In other words, the MCCH Neighbor info 1115 includes SIB 5/6 and SIB_MCCH information.
of the neighbor cells.

**[0095]** The UE directly accesses a MCCH of a candidate cell and acquires the MTCH control information, using the MCCH_Neighbor info 1115 transmitted over the MCCH of the serving cell.

**[0096]** The MCCH_Neighbor info 1115 includes, for each neighbor cell, a primary scrambling code (SC), S-CCPCH information of FACH/PCH TFCS, PCH/FACH TFS, SF, and Code Number, to which MCCH is mapped, and MCCH scheduling information SIB_MCCHx_POS, SIB_MCCHx_REP, SIB_MCCHx_POS, and SIB_MCCHx_COUNT of neighbor cells. Here, a letter ‘x’ indicates a neighbor cell index. Scheduling information for MCCH of the serving cell is notified to UEs over SIB_MCCH 1105. The SIB_MCCH 1105 includes MCCH scheduling information such as MCCH_REP 1130, MCCH_POS 1132, and MCCH_COUNT 1134. The scheduling information of the serving cell and neighbor cells has already been described above with reference to FIG. 10.

**[0097]** That is, the MCCH data 1110 is broadcasted over an S-CCPCH at periods of MCCH_REP 1130 with a length of MCCH_COUNT 1134. A start point of the MCCH data 1110 becomes the MCCH_POS 1132. An unit of the MCCH_REP 1130 and the MCCH_COUNT 1134 becomes a radio frame having a length of, for example, 10 ms. The MCCH_POS 1132 is expressed as a system frame number (SFN) of a corresponding cell. The SFN is a value broadcasted over a P-CCPCH, and is a value of a radio frame unit having a value between 0 and 4095.

**[0098]** A UE receives the MCCH data 1110 on an S-CCPCH based on the MCCH_POS 1132, MCCH_REP 1130, and MCCH_COUNT 1134. That is, the UE regards S-CCPCH data received for the MCCH_COUNT 1134 from SFN of MCCH_POS 1132 + k*MCCH_REP 1130 (where k = 0,···), as the MCCH data 1110. The MCCH data can be mapped to an FACH, which is a transport channel.

**[0099]** FIGs. 13A to 13C are flowcharts illustrating an operation of a UE according to the third embodiment of the present invention. First, an operation of acquiring MTCH configuration information of neighbor cells by a UE in a serving cell will be described with reference to FIG. 13A.

**[0100]** Referring to FIG. 13A, in step 1205, the UE receives an MBMS service over an MTCH from a serving cell. At the same time, in step 1210, the UE periodically receives control information for the MBMS service from the serving cell. That is, the UE receives SIB 3/4, SIB 5/6, SIB 11/12, and SIB_MCCH transmitted over a P-CCPCH of the serving cell. The SIB 3/4 includes criteria MBMS parameters designating cell reselection criteria for neighbor cells, and the SIB 11/12 includes information (cell ID and P-CPICH information) on neighbor cells, which become measurement objects. Information included in the SIB 3/4 and SIB 11/12 has already been described with reference to FIG. 7. In addition, the SIB_MCCH includes MCCH scheduling information shown by reference numeral 1105 illustrated in FIG. 12.

**[0101]** In step 1220, the UE receives MCCH data 1110 transmitted from the serving cell, using the SIB_MCCH 1105. The MCCH data 1110, as illustrated in FIG. 10, can be transmitted over a particular time period of S-CCPCH, and the particular time period is determined based on scheduling information of SIB_MCCH. In step 1225, the UE acquires MCCH configuration information MCCH_Neighbor info 1115 of neighbor cells, included in the MCCH data 1110. In step 1230, the UE stores the MCCH_Neighbor info 1115 and measurement information for the neighbor cells, acquired through the SIB 3/4 and SIB 11/12. The measurement information includes cell IDs of neighbor cells, a primary scrambling code of P-CPICH, RSCP and/or Ec/No of measurement objects, measurement parameters of Q_rxlevmin, Q_qualmin, Q_hyst, and Q_offset_s_n.

**[0102]** After the procedure of FIG. 13A is performed, an MCCH information acquisition operation illustrated in FIG. 13B or a target cell reselection operation illustrated in FIG. 13C can be selected by the UE.

**[0103]** Referring to FIG. 13B, in step 1235, the UE measures P-CPICHS from neighbor cells. Information on the neighbor cells is received through the SIB 11/12 of the serving cell, received in step 1210, and information on the measurement objects is received through the SIB 3/4 of the serving cell, received in step 1210. Parameters measured in step 1235 include Q_qualmeas or Ec/No, and Q_rxlevmeas or RSCP.

**[0104]** After measuring Q_qualmeas and Q_rxlevmeas for the neighbor cells, the UE determines in step 1240 whether one of the neighbor cells satisfies a criteria MBMS condition given through the SIB 3/4. The "criteria MBMS condition" is that the RSCP measurement value Q_rxlevmeas is larger than the minimum P-CPICH RSCP value Q_rxlevmin detected through the SIB 3/4, and the Ec/No measurement value Q_qualmeas is larger than the minimum P-CPICH Ec/No value Q_qualmin detected through the SIB 3/4.

**[0105]** If there are neighbor cells satisfying the condition that the RSCP measurement value Q_rxlevmeas is larger than the minimum RSCP value Q_rxlevmin and the Ec/No measurement value Q_qualmeas is larger than the minimum Ec/No value Q_qualmin, the UE identifies the neighbor cells satisfying the criteria MBMS condition as candidate cells, and then proceeds to step 1245. However, if there are no candidate cells which satisfy the criteria MBMS condition, the UE returns to step 1235. In this case, the UE can use MBMS availability information of the neighbor cells included in the SIB 11/12 before being transmitted.

**[0106]** In step 1245, the UE receives MCCH data of candidate cells. In this case, the UE receives the MCCH data of candidate cells using MCCH configuration information of the candidate cells among MCCH_Neighbor info 1115 previously acquired in step 1225 so that the UE does not acquire MB and SIBs on P-CCPCHs of the candidate cells determined in step 1240. The MCCH configuration information includes S-CCPCH information (FACH/PCH TFCS, FACH TFS, SF, and Code Number).
of corresponding candidate cells, and MCCH scheduling information (MCCH_REP, MCCH_POS, and MCCH_COUNT) on the S-CCPCHs.

[0107] In step 1250, if MTCH control information for an MBMS service that the UE desires to receive exists in the MCCH data, the UE stores the MTCH control information as MTCH_INFO, and then returns to step 1235. FIG. 13C is a flowchart illustrating a procedure for reselecting a particular target cell by a UE. The procedure illustrated in FIG. 13C is performed in parallel with or after the procedure of FIG. 13B.

[0108] Referring to FIG. 13C, in step 1255, the UE measures P-CPICHs from neighbor cells. The measurement in the step 1255 is substantially identical to the measurement in the step 1235. Preferably, the UE measures RSCP and Ec/No of P-CPICHs from the neighbor cells or the candidate cells identified in the step 1240.

[0109] In step 1260, the UE determines priorities of the candidate cells and a serving cell using the measurement values to determine whether a cell reselection procedure is detected. The priorities are determined by comparing R_n calculated for the candidate cells with R_s calculated for the serving cell. If R_n of a certain candidate cell X is higher than the R_s of the serving cell, the UE proceeds to step 1265, determining that the cell reselection is detected. If the R_s is higher than R_n of all candidate cells, the UE returns to step 1255. Here, a candidate cell having the highest R_n among the candidate cells having R_n that is higher than R_s of the serving cell is selected as a target cell.

[0110] In step 1265, the UE determines whether MTCH control information of the target cell is stored in MTCH_INFO. If the MTCH control information is stored in MTCH_INFO, the UE reconstructs in step 1270 a receiver using the MTCH control information and starts receiving an MBMS service data stream transmitted over MTCH of the target cell.

[0111] As can be understood from the foregoing description, the present invention supports an efficient MBMS service by supporting mobility of a UE receiving an MBMS service. In addition, the UE previously stores control information for an MBMS service supported in a target cell before performing cell reselection from a serving cell to the target cell, thereby seamlessly providing the MBMS service.

[0112] While the present invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the present invention as defined by the appended claims.

Claims

1. A cell reselection method by a user equipment receiving a Multimedia Broadcast/Multicast Service, MBMS, service in a serving cell of a mobile communication system including a plurality of cells and providing the MBMS service, the method comprising the steps of:

   receiving, in the serving cell, system information including scheduling information of a control data over an MBMS control channel, MCCH, of the serving cell; and

   receiving the control data of the serving cell according to the scheduling information, and storing the received control data; and

   if cell reselection to a target cell, which is one of the neighbor cells, is determined, moving to the target cell by utilizing the configuration information stored for the target cell,

   wherein the control data include configuration information necessary for accessing MCCHs of neighbor cells and control information necessary for accessing an MBMS data transport channel, MTCH, of the serving cell,

   wherein the scheduling information include a transmission period, a transmission time, and a data length for one period, for the control data on a code channel to which the MCCH of the serving cell is mapped.

2. The cell reselection method of claim 1, wherein the configuration information includes a primary scrambling code, a transport format, a spreading factor, and a code number for each code channel to which the MCCHs of the neighbor cells are mapped.

3. The cell reselection method of claim 2, wherein the configuration information further includes scheduling information for the MCCHs of the neighbor cells.

4. The cell reselection method of claim 3, wherein the scheduling information includes a transmission period, a transmission time, and a data length for one period, for control information on a code channel to which a corresponding MCCH is mapped.

5. The cell reselection method of claim 1, wherein the control information includes a spreading factor, a code number, and a transport format set of a code channel to which the MTCH of the serving cell is mapped.

6. The cell reselection method of claim 5, wherein the control information further includes a service identifier for each MBMS service provided in the serving cell, packet data convergence protocol information formed for an MBMS stream, and radio link control information for the MBMS stream.

7. The cell reselection method of claim 1, wherein the cell reselection to the target cell is performed by the
steps of:

- measuring qualities of signals from the serving cell and the neighbor cells;
- designating the neighbor cells satisfying a service criterion provided from the serving cell as candidate cells;
- receiving control information necessary for accessing MTCHs of the candidate cells, over MCCHs of the candidate cells, using configuration information stored for the candidate cells;
- storing the received control information;
- determining priorities of the serving cell and the candidate cells;
- if there is at least one candidate cell having a priority that is higher than the priority of the serving cell, selecting the at least one candidate cell having a highest priority as a target cell; and
- receiving an MBMS data stream over an MTCH of the target cell using control information stored for the target cell.

8. The cell reselection method of claim 7, wherein the signal qualities include a received signal code power, RSCP, and a chip-energy-to-noise ratio Ec/No for common pilot channels of the neighbor cells.

9. The cell reselection method of claim 7, wherein the service criterion is satisfied when the measured RSCP is larger than a first minimum value provided from the serving cell and the measured Ec/No is larger than a second minimum value provided from the serving cell.

10. The cell reselection method of claim 7, wherein the step of determining the priorities comprises the steps of:

- calculating the priority of the serving cell by adding one of an RSCP and an Ec/No measured for the serving cell to a weight previously given for the serving cell; and
- calculating the priorities of the candidate cells by subtracting a weight previously given for each of the candidate cells from one of an RSCP and an Ec/No measured for each of the candidate cells.

11. A method for providing a Multimedia Broadcast/Multicast Service, MBMS, service to a user equipment moving between a plurality of cells in a mobile communication system providing the MBMS service, the method comprising the steps of:

- transmitting system information including information on a secondary common control channel for an MBMS service of a serving cell over a primary common control channel of the serving cell; and
- transmitting control data including configuration information necessary for accessing MBMS control channels, MCCHs, of neighbor cells and control information necessary for accessing an MBMS data transport channel, MTCH, of the serving cell, over the secondary common control channel of the serving cell, while providing the MBMS service over the MTCH of the serving cell,

wherein the system information includes first system information including scheduling information of the control data, and second system information including a spreading factor, a code number, and a transport format set of a code channel over which the control data is transmitted.

12. The method of claim 11, wherein the configuration information includes a primary scrambling code, a transport format, a spreading factor, and a code number of each code channel to which the MCCHs of the neighbor cells are mapped.

13. The method of claim 12, wherein the configuration information further includes scheduling information for the MCCHs of the neighbor cells.

14. The method of claim 13, wherein the scheduling information includes a transmission period, a transmission time, and a data length for one period, for the control information on a code channel to which a corresponding MCCH is mapped.

15. The method of claim 11, wherein the control information includes a spreading factor and a code number of a code channel to which the MTCH of the serving cell is mapped.

16. The method of claim 15, wherein the control information further includes a service identifier for each MBMS service provided in the serving cell, packet data convergence protocol information for an MBMS stream, radio link control information for the MBMS stream, and a transport format set of the MBMS stream.

Patentansprüche

1. Verfahren zum Auswählen einer anderen Zelle durch ein Benutzer-Endgerät, das einen MBMS-Dienst (Multimedia Broadcast/Multicast service) in einer betreuenden Zelle eines Mobilkommunikationssystems empfängt, das eine Vielzahl von Zellen enthält und den MBMS-Dienst bereitstellt, wobei das Verfahren die folgenden Schritte umfasst:
Empfangen von Systeminformationen, die Scheduling-Informationen von Steuerdaten einschließen, in der betreuenden Zelle über einen MBMS-Steuerkanal der betreuenden Zelle; und Empfangen der Steuerdaten der betreuenden Zelle entsprechend den Scheduling-Informationen und Speichern der empfangenen Steuerdaten; und wenn festgestellt wird, dass eine Zielzelle, die eine der Nachbarzellen ist, als andere Zelle ausgewählt wird, Bewegen zu der Zielzelle unter Verwendung der für die Zielzelle gespeicherten Konfigurationsinformationen,

wobei die Steuerdaten Konfigurationsinformationen, die erforderlich sind, um auf MBMS-Steuerkanälen von Nachbarzellen zuzugreifen, sowie Steuerinformationen einschließen, die erforderlich sind, um auf einen MBMS-Datentransportkanal der betreuenden Zelle zuzugreifen, und die Scheduling-Informationen eine Sendeperiode, eine Sendezzeit sowie eine Datendauer für eine Periode für die Steuerdaten auf einem Code-Kanal einschließen, dem der MBMS-Steuerkanal der betreuenden Zelle zugeordnet ist.

2. Verfahren zum Auswählen einer anderen Zelle nach Anspruch 1, wobei die Konfigurationsinformationen einen primären Scrambling-Code, ein Transportformat, einen Spreizfaktor und eine Codenummer für jeden Code-Kanal einschließen, dem die MBMS-Steuerkanäle der Nachbarzellen zugeordnet sind.

3. Verfahren zum Auswählen einer anderen Zelle nach Anspruch 2, wobei die Konfigurationsinformationen des Weiteren Scheduling-Informationen für die MBMS-Steuerkanäle der Nachbarzellen einschließen.


5. Verfahren zum Auswählen einer anderen Zelle nach Anspruch 1, wobei die Steuerinformationen einen Spreizfaktor, eine Codenummer und ein Transportformat Set eines Code-Kanals einschließen, dem der MBMS-Datentransportkanal der betreuenden Zelle zugeordnet ist.


7. Verfahren zum Auswählen einer anderen Zelle nach Anspruch 1, wobei die Auswahl der Zielzelle als die andere Zelle mit den folgenden Schritten durchgeführt wird:

- Messen von Qualitäten von Signalen von der betreuenden Zelle und den Nachbarzellen;
- Bestimmen der Nachbarzellen, die ein Dienstkriterium erfüllen, das von der betreuenden Zelle bereitgestellt wird, als Kandidaten-Zellen;
- Empfangen von Steuerinformationen, die erforderlich sind, um auf MBMS-Datentransportkanäle der Kandidaten-Zellen zuzugreifen, über MBMS-Steuerkanäle der Kandidaten-Zellen unter Verwendung für die Kandidaten-Zellen gespeicherter Konfigurationsinformationen; Speichern der empfangenen Steuerinformationen;

8. Verfahren zum Auswählen einer anderen Zelle nach Anspruch 7, wobei die Signalqualitäten RSCP (received signal code power) und Ec/No (chip-energy-to-noise ratio) für gemeinsame Pilotkanäle der Nachbarzellen einschließen.

9. Verfahren zum Auswählen einer anderen Zelle nach Anspruch 7, wobei das Dienstkriterium erfüllt ist, wenn die gemessene RSCP größer ist als ein erster Minimalwert, der von der betreuenden Zelle bereitgestellt wird, und das gemessene Ec/No größer ist als ein zweiter Minimalwert, der von der betreuenden Zelle bereitgestellt wird.

10. Verfahren zum Auswählen einer anderen Zelle nach Anspruch 7, wobei der Schritt des Feststellens der Prioritäten die folgenden Schritte umfasst:

- Berechnen der Priorität der betreuenden Zelle durch Addieren von RSCP oder Ec/No, die für die betreuende Zelle gemessen werden, zu einem Gewicht, das der betreuenden Zelle zuvor verliehen wurde; und Berechnen der Prioritäten der Kandidaten-Zellen durch Subtrahieren eines Gewichtes, das
zuvor jeder der Kandidaten-Zellen verliehen wurde, von RSCP oder Ec/No, die für jede der Kandidaten-Zellen gemessen werden.

11. Verfahren zum Bereitstellen eines MBMS-Dienstes (Multimedia Broadcast/Multicast service) für ein Benutzer-Endgerät, das sich zwischen einer Vielzahl von Zellen in einem Mobilkommunikationssystem bewegt, das den MBMS-Dienst bereitstellt, wobei das Verfahren die folgenden Schritte umfasst:

Senden von Systeminformationen, die Informationen über einen zweiten gemeinsamen Steuerkanal für einen MBMS-Dienst einer betreuenden Zelle einschließen, über einen primären gemeinsamen Steuerkanal der betreuenden Zelle; und
Senden von Steuerdaten, die Konfigurationsinformationen, die zum Zugreifen auf MBMS-Steuerkanäle von Nachbarzellen erforderlich sind, sowie Steuerinformationen einschließen, die zum Zugreifen auf einen MBMS-Datentransportkanal der betreuenden Zelle erforderlich sind, über den sekundären gemeinsamen Steuerkanal der betreuenden Zelle, während der MBMS-Dienst über den MBMS-Datentransportkanal der betreuenden Zelle bereitgestellt wird, wobei die Systeminformationen erste Systeminformationen, die Scheduling-Informationen der Steuerdaten einschließen, und zweite Systeminformationen, die einen Spreizfaktor, eine Codenummer und ein Transport Format Set eines Code-Kanals einschließen, über den die Steuerdaten gesendet werden.


13. Verfahren nach Anspruch 12, wobei die Konfigurationsinformationen des Weitern Scheduling-Informationen für die MBMS-Steuerkanäle der Nachbarzellen einschließen.


Revendications

1. Procédé de resélection de cellule par un équipement d’utilisateur recevant un service de diffusion/multidiffusion multimédia, soit MBMS ou Multimedia Broadcast/Multicast Service, dans une cellule de desserte d’un système de communication mobile comprenant une pluralité de cellules et fournissant le service MBMS, le procédé comprenant les étapes consistant à :

recevoir, dans la cellule de desserte, des informations de système comprenant des informations d’ordonnancement de données de contrôle d’un canal de contrôle MBMS, soit MCCH ou MBMS Control CHannel, de la cellule de desserte ; et
recevoir les données de contrôle de la cellule de desserte conformément aux informations d’ordonnancement et enregistrer les données de contrôle reçues ; et si une resélection de cellule est déterminée vers une cellule cible, celle-ci étant une des cellules voisines, se déplacer vers la cellule cible en utilisant les informations de configuration enregistrées pour la cellule cible,

dans lequel les données de contrôle comprennent des informations de configuration nécessaires pour accéder aux MCCH de cellules voisines et des informations de contrôle nécessaires pour accéder à un canal de transport de données MBMS, soit MTCH ou MBMS data Transport CHannel, de la cellule de desserte, dans lequel les informations d’ordonnancement comprennent une période de transmission, un temps de transmission et une longueur de données pour une période, pour les données de contrôle sur un canal de codification auquel le MCCH de la cellule de desserte est mappé.

2. Procédé de resélection de cellule selon la revendication 1, dans lequel les informations de configuration comprennent un code de brouillage primaire, un format de transport, un facteur de dispersion et un
numéro de code pour chaque canal de codification auquel les MCCH des cellules voisines sont mappés.

3. Procédé de résélection de cellule selon la revendication 2, dans lequel les informations de configuration comprennent en outre des informations d’ordonnancement pour les MCCH des cellules voisines.

4. Procédé de résélection de cellule selon la revendication 3, dans lequel les informations d’ordonnancement comprennent une période de transmission, un temps de transmission et une longueur de données pour une période, pour des informations de contrôle sur un canal de codification auquel un MCCH correspondant est mappé.

5. Procédé de résélection de cellule selon la revendication 1, dans lequel les informations de contrôle comprennent un facteur de dispersion, un numéro de code et un jeu de format de transport d’un canal de codification auquel le MTCH de la cellule de desserte est mappé.

6. Procédé de résélection de cellule selon la revendication 5, dans lequel les informations de contrôle comprennent en outre un identifiant de service pour chaque service MBMS fourni dans la cellule de desserte, des informations de protocole de convergence de données de paquet formées pour un flux MBMS et des informations de contrôle de liaison radio pour le flux MBMS.

7. Procédé de résélection de cellule selon la revendication 1, dans lequel la résélection de cellule vers la cellule cible est effectuée par les étapes consistant à:

- mesurer des qualités de signaux provenant de la cellule de desserte et de cellules voisines ;
- désigner les cellules voisines satisfaisant à un critère de service fourni par la cellule de desserte comme cellules candidates ;
- recevoir des informations de contrôle nécessaires pour accéder aux MTCH des cellules candidates, via des MCCH des cellules candidates, en utilisant des informations de configuration enregistrées pour les cellules candidates ;
- enregistrer les informations de contrôle reçues ;
- déterminer des priorités de la cellule de desserte et des cellules candidates ;
- s’il y a au moins une cellule candidate ayant une priorité supérieure à celle de la cellule de desserte, sélectionner l’au moins une cellule candidate ayant la plus haute priorité comme cellule cible ; et
- recevoir un flux de données MBMS via un MTCH de la cellule cible en utilisant des informations de contrôle enregistrées pour la cellule cible.

8. Procédé de résélection de cellule selon la revendication 7, dans lequel les qualités de signal comprennent une puissance de code de signal reçu, soit RSCP ou Received Signal Code Power, et un ratio énergie-de-pace/bruit Ec/No pour des canaux pilotes communs des cellules voisines.

9. Procédé de résélection de cellule selon la revendication 7, dans lequel le critère de service est rempli lorsque la RSCP mesurée est supérieure à une première valeur minimale fournie par la cellule de desserte et le ratio Ec/No mesuré est supérieur à une seconde valeur minimale fournie par la cellule de desserte.

10. Procédé de résélection de cellule selon la revendication 7, dans lequel l’étape de détermination des priorités comprend les étapes consistant à:

- calculer la priorité de la cellule de desserte en ajoutant soit une RSCP, soit un ratio Ec/No mesuré pour la cellule de desserte, à un terme de pondération donné précédemment pour la cellule de desserte ; et
- calculer les priorités des cellules candidates en soustrayant un terme de pondération donné précédemment pour chacune des cellules candidates soit d’une RSCP, soit d’un ratio Ec/No mesuré pour chacune des cellules candidates.

11. Procédé pour procurer un service de diffusion/multidiffusion multimédia, soit MBMS, à un équipement d’utilisateur se déplaçant entre une pluralité de cellules dans un système de communication mobile procurant le service MBMS, le procédé comprenant les étapes consistant à:

- transmettre des informations de système comprenant des informations concernant un canal de contrôle commun secondaire pour un service MBMS d’une cellule de desserte via un canal de contrôle commun primaire de la cellule de desserte ; et
- transmettre des données de contrôle comprenant des informations de configuration nécessaires pour accéder à des canaux de contrôle MBMS, soit MCCH, de cellules voisines et des informations de contrôle nécessaires pour accéder à un canal de transport de données MBMS, soit MTCH, de la cellule de desserte, via le canal de contrôle commun secondaire de la cellule de desserte, tout en procurant le service MBMS via le MTCH de la cellule de desserte,

dans lequel les informations de système comportent des premières informations de système comprenant des informations d’ordonnancement des données
de contrôle et des secondes informations de système comportant un facteur de dispersion, un numéro de code et un jeu de format de transport d’un canal de codification via lequel les données de contrôle sont transmises.

12. Procédé selon la revendication 11, dans lequel les informations de configuration comprennent un code de brouillage primaire, un format de transport, un facteur de dispersion et un numéro de code pour chaque canal de codification auquel les MCCH des cellules voisines sont mappés.

13. Procédé selon la revendication 12, dans lequel les informations de configuration comprennent en outre des informations d’ordonnancement pour les MCCH des cellules voisines.

14. Procédé selon la revendication 13, dans lequel les informations d’ordonnancement comprennent une période de transmission, un temps de transmission et une longueur de données pour une période, pour les informations de contrôle sur un canal de codification auquel un MCCH correspondant est mappé.

15. Procédé selon la revendication 11, dans lequel les informations de contrôle comprennent un facteur de dispersion et un numéro de code d’un canal de codification auquel le MTCH de la cellule de desserte est mappé.

16. Procédé selon la revendication 15, dans lequel les informations de contrôle comprennent en outre un identifiant de service pour chaque service MBMS fourni dans la cellule de desserte, des informations de protocole de convergence de données de paquet pour un flux MBMS, des informations de contrôle de liaison radio pour le flux MBMS et un jeu de format de transport pour le flux MBMS.
FIG. 5

START

ACQUIRE INFORMATION ON NEIGHBOR CELLS

MEASURE POWER LEVELS OF NEIGHBOR CELLS

DETERMINE PRIORITIES OF NEIGHBOR CELLS AND SERVING CELL

MOVE TO TARGET CELL

END
START

610
ACQUIRE INFORMATION ON NEIGHBOR CELLS

620
MEASURE NEIGHBOR CELLS

630
CHECK CRITERIA MBMS CONDITION

640
ACQUIRE MITCH-RELATED INFORMATION OF CANDIDATE CELLS

650
DETERMINE PRIORITIES OF NEIGHBOR CELLS AND SERVING CELL

660
MOVE TO TARGET CELL

END

FIG. 6
FIG. 8A
FIG. 8B
FIG. 11A
FIG. 11B
FIG. 13A
START

MEASURE NEIGHBOR CELLS

SATISFACTORY OF A CRITERIA MBMS CONDITION?

YES

READ MCCH OF CANDIDATE CELL

ACQUIRE MTCH INFORMATION OF CANDIDATE CELL AND STORE MTCH INFORMATION AS MTCH INFO

FIG. 13B
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

• WO 03017713 A [0010]

Non-patent literature cited in the description

• Definitions and Characteristics of Multicast Channels, 08 March 1999, 1-11 [0009]